

AMENDMENTS TO THE DRAWING

Fig. 2A is amended to include reference numeral 35 and lead line indicating the space enclosed by the package lid, as indicated by the Examiner on page 2 of the final Office action.

Fig. 2B is amended to include section line A-A', which Fig. 2A refers to, to provide additional clarity to Fig. 2A, as discussed in the telephonic conference with the Examiner on November 30, 2006.

A Replacement Sheet of Figs. 2A, 2B, and 2C is attached.

Replacement Sheet: Figures 2A-C

REMARKS

I. STATUS OF THE CLAIMS AND RESPONSE TO OBJECTIONS

Claims 1-32 are pending. Claims 22-30 stand withdrawn. Claims 1-21, 31, and 32 stand rejected.

The drawings are objected to "because the disclosure fails to describe the "space" or "gap" that is enclosed by package lid 10, substrate 24 and semiconductor IC 26; and that surrounds chips 36 and/or 38 [see figures 2A and 2C]" (Office Action, page 2, ¶1). Fig. 2A is amended to include reference numeral 35 and lead line indicating the space enclosed by the package lid. Fig. 2B is amended to include section line A-A', which Fig. 2A refers to, to provide additional clarity to Fig. 2A, as discussed in the telephonic conference with the Examiner on November 30, 2006. A Replacement Sheet of Figs. 2A, 2B, and 2C is attached. A sheet of the Annotated Marked-up Drawings is also enclosed. These amendments do not add new matter.

Paragraph [0023] is amended to incorporate the language of claim 11 (with the inclusion of reference numerals), which provides support in the written description for the term "gap" recited in claim 11, in accordance with 37 C.F.R. §1.71(a)). This amendment to the written description does not add new matter because it merely conforms the written description to the claims and figures. If further changes are required, the undersigned respectfully requests that such changes be entered by Examiner's amendment, if possible.

II. REJECTIONS UNDER 35 U.S.C. § 112

Claims 1-21 and 31-32 are rejected under 35 U.S.C. § 112, ¶1, "because the specification, while being enabling for forming the molding compound on the exterior surface of the sloped wall, does not reasonable provide enablement for the use of the term "only" as recited in the amended claims" (Office Action, page 3, ¶1). The Examiner further asserts that "the disclosure fails to describe how the chips (36) and (38), and the interior walls of the package lid (10) are protected from being encapsulated with molding compound (30), especially when vents or holes are provided on the package lid (10)" (Office Action, page 3, ¶2).

The Examiner has acknowledged that the specification is “enabling for forming the molding compound on the exterior surface of the sloped wall.” The Applicant respectfully asserts that the Examiner’s acknowledgment supports the position that claims 1 and 31 (neither of which recites a vent) are enabled, and respectfully requests reconsideration and removal of these rejections.

The Applicant shows, describes, and claims “molding compound contacting only an exterior surface of the sloped wall so as to secure the package lid to the package substrate of the packaged semiconductor”. Claim 1 further recites “a sloped wall configured to provide an exposed perimeter portion of the package substrate when the package lid is disposed on the package substrate to allow application of a molding compound on the exposed perimeter portion of the package substrate”. Any person of ordinary skill in the art would be reasonably apprised how to use the package lid of claim 1, namely, by applying a molding compound on the exposed perimeter portion of the package substrate, and not to the interior of the lid.

Several encapsulation techniques are well known in the art of integrated circuit packaging. For example, encapsulant can be dispensed on selected areas of a package, as described in *Total Dispensing Solutions*, published by Asymtek (Spring 1998) (Exhibit A). Design tools, such as software, is commercially available for such use (*Id.*, page 2). Similarly, a solid encapsulant member (“preform”) could be applied to an exposed edge of a package substrate (see, *e.g.*, U.S. Patent No. 5,455,456 by Newman, “ring” 206). Other techniques inject encapsulant into a mold form. U.S. Patent No. 6,654,248 B1 by Fishley et al. (hereinafter “Fishley”), already of record, describes using a mold form 24 and injecting molding compound 20 through a top gate 26.

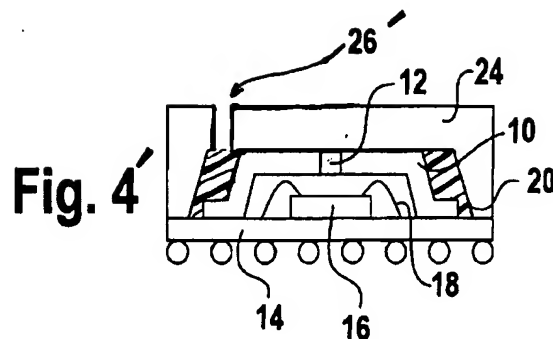
Fig. 3 of U.S. Patent No. 6,525,421 B1 by Chia et al., shows how a space 38 in a mold form 16, 18 can be shaped so that molding compound is applied to selected areas, in this case a perimeter portion of the integrated circuit die 30 to encapsulate and protect the bondwires, and not to selected areas, such as the top 36 of the integrated circuit die, which is covered by the abutting surface 40 of the top mold piece 16.

The undersigned respectfully asserts that claims 1 and 31 are enabled in accordance with 35 U.S.C. § 112, ¶1, and requests reconsideration of claims 1 and 31 and removal of these rejections.

Claims 9-11 and 32 recite a vent. The Examiner states that these “vents inherently allow air and/or the molding compound to pass through the package lid to form an encapsulant for enclosing an “internal” chip”. Claims 1, 31, and 32 do not recite or relate to molding compound passing through a package lid to form an encapsulant enclosing an internal chip.

It is not inherent that molding compound pass through a vent in a package lid. For example, the vent could be covered by an abutting surface, similar to the top mold piece 16 of Chia. In other words, the mold space (see Chia, ref. num. 38) that encapsulant might be supplied to adjoins the external portions of the exposed perimeter portion of the package substrate and external portions of the sloped wall of the metal package lid, but not the vent or internal area of the lid. Alternatively, molding compound could be selectively dispensed to avoid the vent, or a molding compound preform that did not overlap the vent could be used. One of ordinary skill in the art would have been reasonably apprised by the Applicants disclosure how to make and use the inventions of claims 9-11 and 32. Claims 9-11 and 32 are enabled in accordance with 35 U.S.C. §112, ¶1. Reconsideration of claims 9-11 and 32 and removal of these rejections is respectfully requested.

As an example of how to avoid passing molding compound through a vent, Fig. 4' (modified figure 4 of Fishley), below, shows how the mold form 24 with the top gap 26' moved from the center (which is essential to achieve the desired flow characteristics of molding compound to avoid wire sweep in the assembly of Fishley) to the side of the mold form. Hatching has been added to illustrate the extent of the resultant molding compound 20, which would not inherently flow through the centrally disposed aperture 12 in the heat spreader 10 of Fishley. Of course, there is no motivation to make such a modification because it would obviate the purpose of the assembly of Fishley, as discussed below.



The arguments above further rebut the rejections of claims 9-11 and 32 for lack of enablement. The Applicant respectfully requests reconsideration of claims 1-21, 31, and 32, and removal of all rejections under 35 U.S.C. § 112, ¶1. Since no other rejection of claim 32 is made in the final Office action, allowance of claim 32 is respectfully requested.

III. REJECTIONS UNDER 35 U.S.C. § 102

The Examiner states that, “[a]s far as understood, claims 1, 3-5, 7-10, 15, 19, 21 and 31 remain rejected under 35 U.S.C. § 102(e) as being anticipated by Fishley et al. (US Patent No. 6,654,248). Claim 1 recites, among other elements, “a sloped wall configured to provide an exposed perimeter portion of the package substrate when the package lid is disposed on the package substrate to allow application of a molding compound on the exposed perimeter portion of the package substrate, the molding compound contacting only an exterior surface of the sloped wall so as to secure the package lid to the package substrate”. As explained above in response to the Examiner’s rejections under 35 U.S.C. § 112, ¶1, the molding compound is not applied to the interior of the lid, nor does it encapsulate the chip. The molding compound is applied on the exposed perimeter portion of the package substrate so as to secure the package lid to the package substrate. Fishley does not disclose this, and teaches away from claim 1.

Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. Fishley

states that “[a] molding compound 20, such as plastic, encapsulates the integrated circuit 16 and the lower level of the heat spreader 10 to the package substrate 14” (Col. 4, lines 18-21) and that “[t]he molding compound 20 is able to flow through the heat spreader 10 through the centrally disposed aperture 12” (Col. 4, lines 41-43). Fishley states that “the primary purpose of the aperture 12 is to allow molding compound, such as plastics, to flow into a top gated mold form and through the heat spreader 10 so as to more uniformly encapsulate an integrated circuit” (Col. 3, lines 51-54). Fishley further states that, “because the molding compound is flowing radially outward from the top center of the package, the flow of the molding compound does not sweep the wires into one another” (Col. 2, lines 45-48).

Fishley does not disclose, and teaches away from, molding compound contacting only an exterior surface of a sloped wall so as to secure a package lid to a package substrate of a packaged semiconductor. A *prima facie* case of anticipation of claim 1 has not been established. Claim 1 and all claims that depend from claim 1 are patentable.

Claim 31 recites, among other elements, means for securing the package lid to the package substrate by applying molding compound to only external portions of the sloped wall of the package lid and the exposed perimeter portion of the package substrate. Fishley discloses flowing molding compound through a central aperture in a heat sink to encapsulate an integrated circuit and bonding wires. Fishley teaches away from claim 31. Fishley does not disclose or suggest claim 31, and claim 31 is patentable.

Claim 9, which depends from claim 1, further recites “a vent allowing gases to escape during assembly of the packaged semiconductor to a printed circuit assembly.” The Examiner must rely on the applicant's disclosure to properly determine the meaning of terms used in the claims. Claim language is analyzed, not in a vacuum, but always in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by one possessing the ordinary level of skill in the pertinent art. The aperture 12 of Fishley would be plugged by molding compound injected between the heat spreader 10 and the integrated circuit 16 during encapsulation of the IC. Fishley teaches away from claim 9 because the plugged aperture would not operate

as a vent and would not allow gases to escape during assembly of the packaged semiconductor to a printed circuit assembly. One of ordinary skill in the art, considering the Applicant's disclosure, Fishley, and claim 11 as wholes, would not consider the plugged aperture of Fishley to be a vent. Fishley does not disclose or suggest claim 9, and claim 9 and all claims that depend from claim 9 are further patentable.

Claim 10, which depends from 9, recites that "the vent is provided in a side of the package lid." The Examiner states that "Fishley et al. further teaches a vent (12) provided on the top side of the package lid (10) [see fig. 3]." The Applicant respectfully traverses the Examiner's position.

The Examiner's characterization of the aperture 12 of Fishley as being on a side of the package lid is strained and unreasonable, and is inconsistent with how one of ordinary skill in the art would interpret claim 10. FIG. 1A of the instant patent application shows a top 18 of a package lid 10, and distinguishes the top 18 from a side of the package lid in paragraph [0023]. Similarly, Fishley describes a top gate 26 through which molding compound flows through the centrally disposed aperture 12 (Col. 4, lines 41-43). One of ordinary skill in the art, considering claim 10, the Applicant's disclosure, and the disclosure of Fishley as wholes, would not consider the aperture 12 of Fishley to be in a side of a package lid.

Fishley teaches away from providing an aperture in the side of the package lid "because the molding compound . . . flowing radially outward from the top center of the package . . . does not sweep the wires into one another" (Col. 2, lines 45-48). An aperture in the side of the heat spreader 10 of Fishley would not flow the molding compound radially outward from a central location to avoid wire sweep. Fishley does not teach or suggest claim 10, and claim 10 and all claims that depend from claim 10 are further patentable.

IV. REJECTIONS UNDER 35 U.S.C. § 103

Claims 2, 6, 11-14, and 16-17 stand rejected as being unpatentable over Fishley in view of U.S. Patent No. 6,246,115 by Tang et al. (hereinafter "Tang"). To establish a *prima facie* case of obviousness, the prior art references must teach or

suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. The Examiner may not use the Applicant's disclosure as a template to re-construct the rejected claim from selected elements of the prior art.

Claim 2, which depends from claim 1, recites that the sloped wall has a slope angle between 30 degrees and 60 degrees. The Examiner states that Tang appears to show a sloped wall of about 45 degrees, and asserts that it would have been obvious to one of ordinary skill in the art to include a sloped wall having an angle of between 30 degrees and sixty degrees, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. However, before a parameter can be optimized, it must be recognized as a result-effective variable.

The Applicant teaches that, "at angles less than 30 degrees, the sloped wall takes up too much room on the package substrate" (§ [0029]), and that "[a]t angles greater than 60 degrees, the force normal to the package substrate decreases" (§ [0029]). Neither reference cited by the Examiner recognizes these effects, or any effect that would lead to claim 2. Tang teaches away from the second effect by filling the holes in the legs with encapsulant to enforce the bonding between the package lid and the encapsulant, as noted by the Examiner in rejecting claim 11. One of ordinary skill in the art, considering the disclosure of Tang as a whole, would not recognize the slope angle as a result-effective variable. The numerical range recited in claim 2 points up the distinctions from, and advantages over, the prior art, and adds precision to claim 2, and should be considered, along with all of the other evidence, in the determination of the patentability of claim 2. Claim 2 is further patentable.

Claim 11, which depends from claim 10, recites that the vent comprises a gap in the sloped wall. The Examiner acknowledges that Fishley fails to teach a gap in the sloped wall, and asserts that Tang "shows a gap (321a) in the sloped wall (321) of the package lid (32)." The Applicant respectfully traverses the Examiner's position.

Each reference must be taken as a whole, including where the references diverge and teach away from the claimed invention. Tang states that "the supportive

legs 321 are each formed with a through hole 321a" (Col. 5, lines 6-7). FIG. 2 of Tang shows these holes 321a being surrounded and plugged with encapsulant. Tang teaches away from claim 11 because one of ordinary skill in the art, considering the Applicant's disclosure, Tang, and claim 11 as wholes, would not consider the plugged holes of Tang to be vents. The urged combination of references does not disclose or suggest all elements of claim 11.

Tang distinguishes between the legs 321 and the sides 324 of the heat sink 32 (see Fig. 3, Col. 5, lines 8-20). The holes 321a are not in the sides 324 of the heat sink, but rather the legs 321. Tang shows the openings 326 through which the encapsulant is dispensed as being near the corners of the heat sink (see, *e.g.* FIG. 1, Col. 4, lines 62-64). Tang also shows the holes 321a in the legs 321 as being near the corners. This teaches away from the centrally located top aperture 12 of Fishley that allows molding compound to flow radially outward.

The suggestion to combine the references must not require substantial reconstruction or redesign of the references to arrive at the claimed invention. The modification urged by the Examiner would have required substantial redesign of both the heat sink and mold cavity of Fishley, and would not result in claim 11. The Examiner has not provided any motivation in the prior art or a convincing line of reasoning why one would want to modify the central aperture 12 of Fishley to be moved to the position disclosed in Tang. No *prima facie* case of obviousness has been established, and claim 11 is further patentable.

Claim 12, which depends from claim 1, further recites "a rim forming a vertical wall around a top of the package lid." The Examiner cites Tang for teaching a vertical wall (V1) around a top (322) of the package lid (32)". In order to establish a *prima facie* case of obviousness, the Examiner must provide motivation for combining the references. No motivation has been provided, and no *prima facie* case of obviousness has been established. Claim 12 is further patentable.

Claim 13, which depends from claim 12, further recites "fiducial marks formed in the rim." The Examiner considers protrusion P1 or 325 formed in the rim V1 as fiducial marks. The Applicant respectfully traverses. Tang states that injection pins 51 in a mold penetrate the openings 326 on the four corners of the heat sink 32 in order to

keep the heat sink in position (Col. 4, lines 64-67); thus teaching away from fiducial marks formed in the rim. Tang describes element 325 as a positioning tongue (Col. 5, line 47) having a curved edge 325a; however, the positioning tongue 325 is not formed in V1, but rather extends beyond V1. Claim 13 is further patentable.

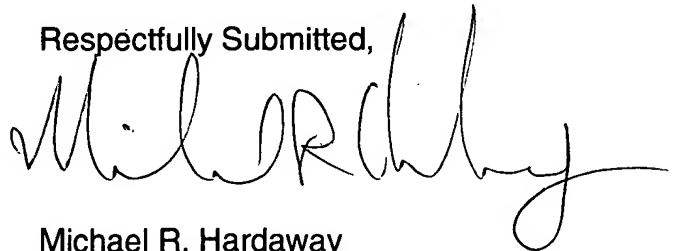
V. REJOINDER OF WITHDRAWN CLAIMS

If any of claims 1-21, 31, or 32 are found to be allowable, the Applicant respectfully requests the Examiner to rejoin and reconsider withdrawn claims 22-30.

CONCLUSION

The Applicant submits that all claims are now in condition for allowance. Favorable reconsideration and timely issuance of a Notice of Allowance are respectfully requested. Should the Examiner consider necessary or desirable any formal changes anywhere in the specification, claims, and/or drawings, then it is respectfully asked that such changes be made by an examiner's amendment, if the Examiner feels this would facilitate passage of the case to issuance. If the Examiner believes a telephone conference would expedite prosecution of this application, the Examiner is cordially invited to telephone the undersigned at (408) 879-6149.

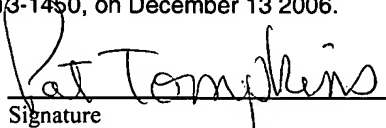
Respectfully Submitted,



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I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: Commissioner for Patents, P.O. BOX 1450, Alexandria, VA 22313-1450, on December 13 2006.

Pat Tompkins
Name


Signature